

# THE WEATHER AND CIRCULATION OF OCTOBER 1962

## A Warm Month With a Mid-Month Circulation Reversal

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### 1. INTRODUCTION

Warmer than normal temperatures prevailed over most of the United States during October 1962, except in New England and the West Coast States, in contrast to the abnormally cool weather of September and the preceding summer [1]. Heavy rain fell along the New England and Pacific coasts, much of it coming with vigorous storms the first half of the month. The most intense of the storms was the extratropical continuation of typhoon Freda which brought high winds as well as heavy rain, took an estimated 56 lives, and caused extensive property damage in California, Oregon, and Washington. Heavy rains in New England with flooding in Massachusetts and Rhode Island were produced by a coastal storm which combined with hurricane Daisy off the New England Coast.

A grand-scale upheaval of the circulation almost completely reversed the weather pattern over the United States from early to late October. After mid-month the circulation changed from cyclonic to anticyclonic in the West with warmer, drier weather, but in the East the circulation became more cyclonic with correspondingly cooler weather.

### 2. MONTHLY MEAN CIRCULATION

The planetary wave pattern of the 700-mb. circulation for October (fig. 1) was similar to the normal over the Northern Hemisphere. Deeper than normal troughs extending from far north to south were observed along the east coast of North America and in the Pacific from the eastern Aleutians to Hawaii. A slightly stronger than normal ridge dominated the circulation in western North America. Moderate blocking was indicated by the distribution of height anomaly (fig. 1) and by the displacement of the westerlies southward across North America and the western Atlantic, as shown in figure 2.

Recurrent blocking over Europe is indicated by the characteristic split in the mean westerly flow, with positive height anomalies centered over the British Isles and a negative anomaly center in the trough off the coast of Africa. The main belt of maximum west winds was displaced northward around the European ridge with

average speeds there in excess of normal by as much as 8 m.p.s.

Downstream from the strong mean ridge over Europe the trough in western Asia was abnormally deep, as was the northern part of the trough along the east coast of Asia. In the south the latter trough was bridged by positive anomalies zonally oriented from China to the strong middle-latitude ridge in the western Pacific. In the tropical region of the western Pacific the general circulation favored the formation of tropical storms of which there were six in the area this month.

### 3. EARLY OCTOBER CIRCULATION AND WEATHER

The strongest anomaly center of the mean circulation in early October was observed in a deep trough in the eastern Pacific (fig. 3A) where 700-mb. heights were more than 400 ft. below normal off the Washington coast. This is an area of particular interest because it was the site of the great Pacific storm of October 11-13. Five-day mean charts for October 9-13, (fig. 4), further illustrate the intensity of the mean trough during the stormy period. Mean 700-mb. heights were nearly 800 ft. below normal, and sea level pressures were about 16 mb. below normal for the 5-day period. Tracks of the three storms which caused high winds and excessive rains along coastal areas of California, Oregon, and Washington, are superimposed on the mean sea level chart (fig. 4B). The extratropical stage of typhoon Freda (II in fig. 4B) caused the highest winds of more

TABLE 1.—New record precipitation totals established in October 1962

Station	October total (in.)	24-hour	
		Total (in.)	Date (Oct. 1962)
Blue Canyon, Calif.....	22.32		
Oakland, Calif.....	8.56	5.45	12-13
Sacramento, Calif.....	6.85		
San Francisco, Calif.....	7.30	3.74	12-13
Burns, Oreg.....	3.08		
Portland, Maine.....	12.27	7.71	6-7
Milton, Mass.....	10.84		
Concord, N.H.....	8.73	4.24	5-6
Providence, R.I.....	11.89	6.63	5-6

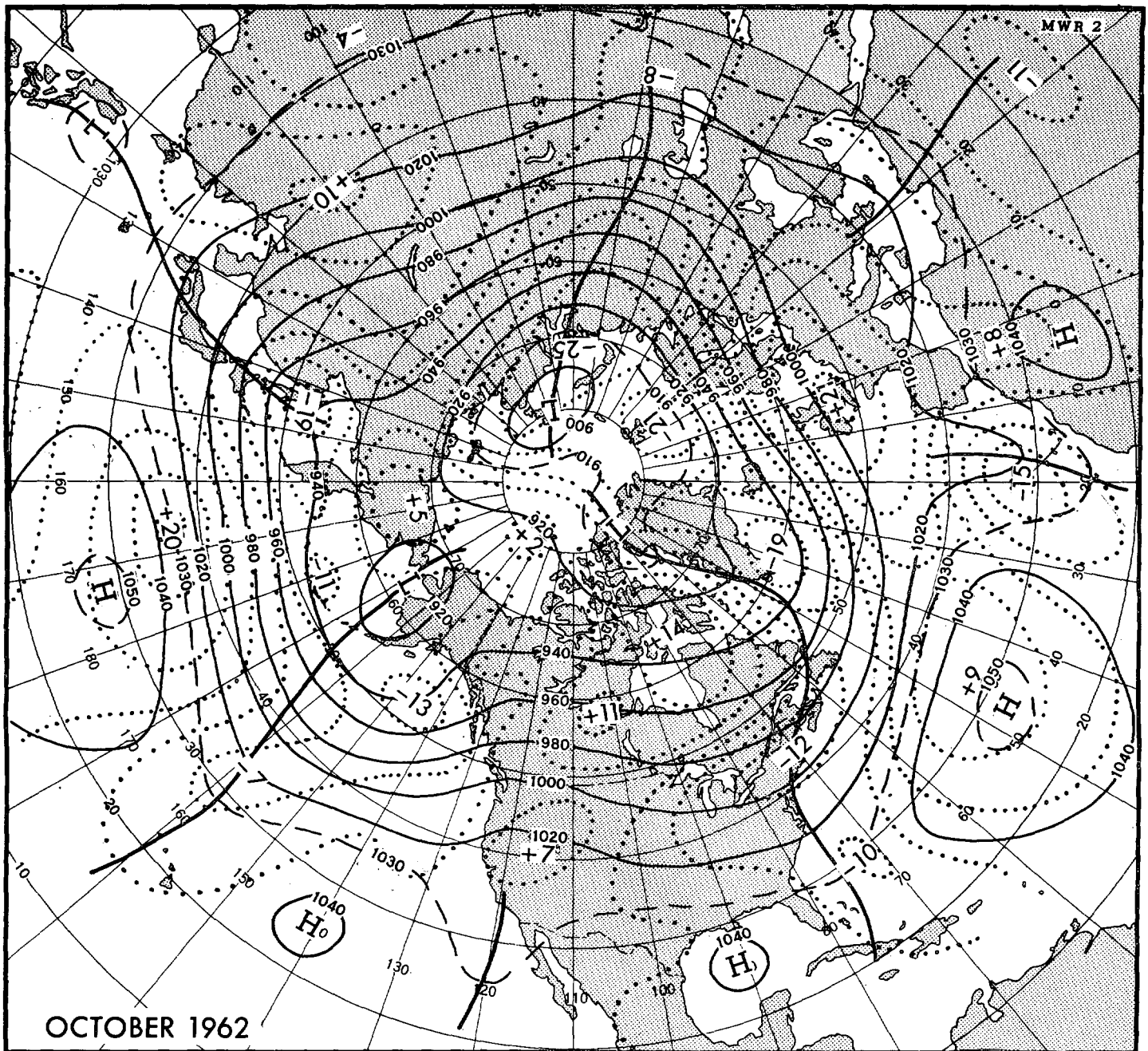


FIGURE 1.—Mean 700-mb. contours (solid) and height departures from normal (dotted), both in tens of feet, for October 1962. The height departure field indicates blocking over eastern North America and Europe.

than 100 m.p.h. Further details can be obtained in a preliminary report by Sumner [2]. The heaviest and most widespread precipitation of the month was attributable to these storms. New records were established at some stations for both 24-hour and monthly totals as listed in table 1.

New precipitation records were also established in New England (table 1), mostly from a frontal wave which intensified on combining with hurricane Daisy the first week of October. A second stormy period occurred there toward the end of the month. New England was in the

normally dry region behind a mean trough (fig. 3A) and the relation between circulation and precipitation there is less clear than in the West. However, blocking over eastern North America during the heaviest rains favored development and slow movement of secondary coastal storms south of New England (see cyclone tracks on fig. 3A), and inhibited eastward motion of hurricane Daisy.

Temperatures averaged below normal over the Pacific Northwest during the first half of the month (fig. 3B), associated with large negative 700-mb. height anomalies and excessive rainfall. There was, however, a southerly

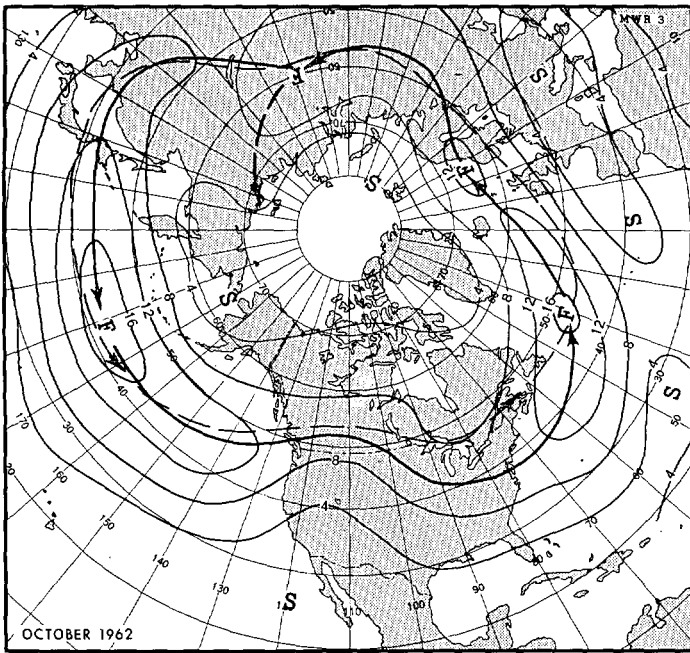


FIGURE 2.—Mean isotachs (in meters per second) of 700-mb. wind speed during October 1962. Solid arrows indicate the observed primary axis of maximum wind speed, heavy dashed arrow a secondary observed maximum, and light dashed arrows the normal. Displacement from normal was pronounced from central North America to northern Asia.

component in the mean 700-mb. flow (fig. 3A) over the remainder of the country, excepting the East Coast States, and temperatures averaged warmer than normal outside the direct influence of the trough. Temperature departures were warmest from the Central Rockies eastward the second week, coincident with the maximum intensity of west coast storminess, and new daily record maxima were established in Colorado, Illinois, and Iowa.

#### 4. CIRCULATION AND WEATHER OF LATE OCTOBER

Remarkably large changes occurred in the mean circulation between the first half of October (fig. 3A) and that of the second half (fig. 5A) as shown in figure 6. The huge rise area centered off the Washington coast marks the replacement of the intense trough of early October by a strong ridge. However, the low-latitude portion of the trough remained as a closed Low near Baja California and effected confluent flow in the Southwest. Falls north of the Bering Sea attended the collapse of a blocking High, while similar falls over Scandinavia accompanied retrogression of a strong ridge into the Atlantic. Average heights fell as much as 500 ft. near James Bay as the ridge in central Canada gave way to a retrograding trough. This amplified circulation pattern produced northwesterly flow across North America during the last half of the month (fig. 5A).

The resulting cooler trend brought temperatures below normal over the eastern half of the United States (fig. 5B). Half-month average temperature anomalies decreased more than 8° F. in the upper Mississippi Valley,

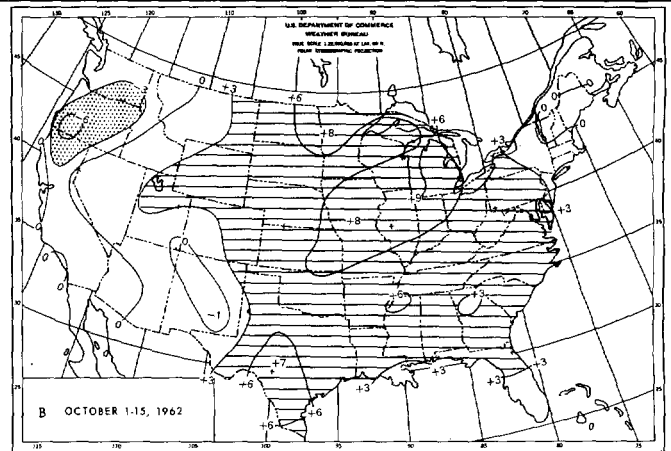
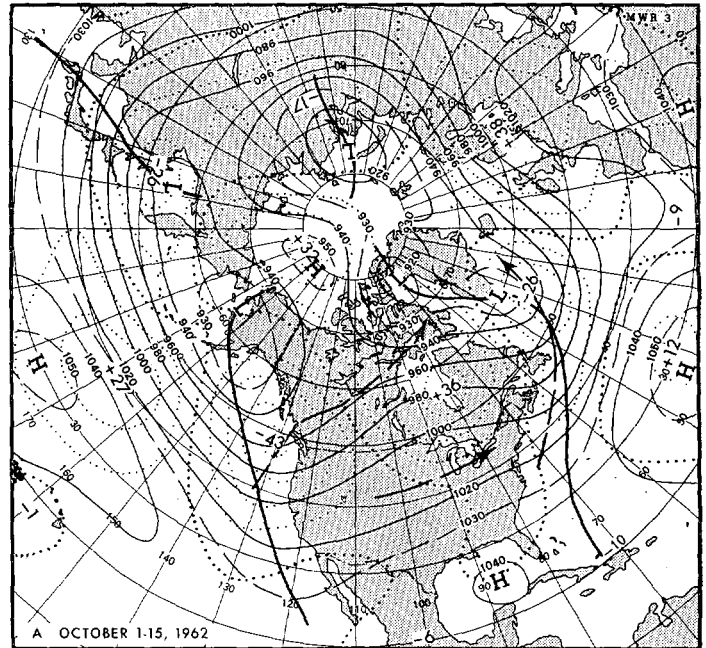


FIGURE 3.—(A) Mean 700-mb. contours (solid) and departures from normal (dotted), both in tens of feet, and (B) departure of average temperature from normal (° F.) for October 1-15, 1962. Temperatures averaged below normal adjacent to troughs off west and east coasts.

the upper Great Lakes Region, and the Ohio Valley. New record daily minima were established from northern Minnesota to South Carolina from the 24th to 27th. The lowest October temperatures on record occurred on the 27th at Greensboro and Wilmington, N.C., Norfolk, Va., and Cleveland, Ohio. Over the West as the circulation became more anticyclonic half-month average temperatures rose above the normal mark. Burns, Oreg., reported the greatest warming between half-months, almost 11° F.

While the anticyclonic environment favoring warmth also encouraged dryness over most of the West, precipitation was generously distributed in the confluent flow east of the Southwest Low. This Low was very persistent and could be found aloft over or near the Southwest almost daily after mid-month.

The persistently cool cyclonic regime over the North-

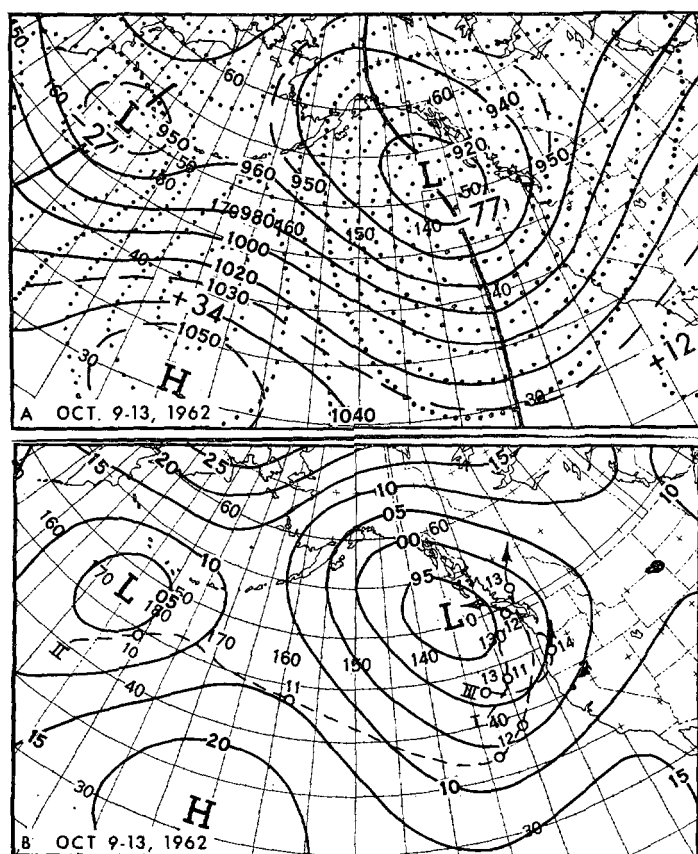


FIGURE 4.—(A) 5-day mean 700-mb. contours (solid) and departures from normal (dotted) for October 9-13, 1962. (B) Mean sea level isobars for same period with tracks of three storm centers which caused high winds and heavy rains in coastal sections of California, Oregon, and Washington. Open circles and dates are for 1200 GMT positions.

east and a northerly component of mean flow across the Great Lakes favored the production of snow. Snowfall at South Bend, Ind. was 8.2 in. greater than normal for the month, and accumulations at Cleveland, Ohio, Worcester, Mass., and Caribou, Maine, established new October records.

### 5. MONTHLY PRECIPITATION AND TEMPERATURE

While in some areas precipitation was of limited duration owing to shorter-period anomalous features of the circulation, in other areas it was more evenly distributed throughout the month. On several occasions troughs or low centers emanated from the southwestern trough and spread precipitation eastward, especially over eastern Oklahoma and northeastern Texas (fig. 7) where the mean circulation for the month (fig. 1) indicated mild confluence of westerlies with moisture-laden southerly flow from the Gulf of Mexico.

The streak of above normal precipitation from Wyoming to the middle Mississippi Valley (fig. 7) was in large part deposited by cyclones following the southern branch of split westerly flow in early October (fig. 3A). One cyclone became cut off south of the Canadian ridge and remained almost stationary in the vicinity of Missouri for several

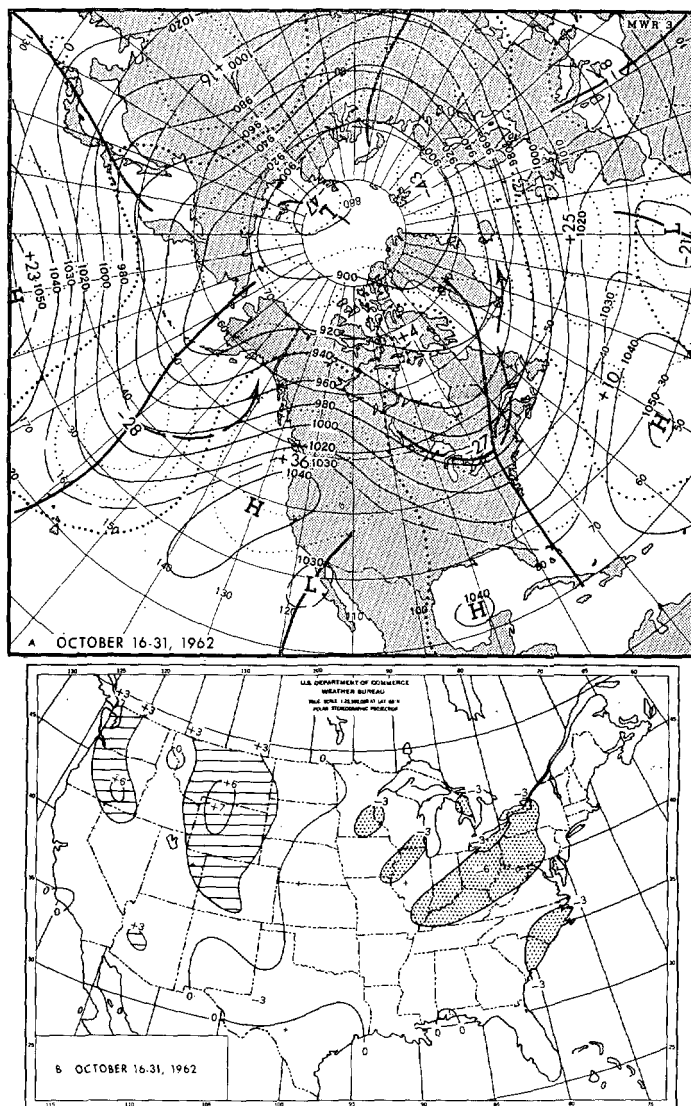


FIGURE 5.—(A) Mean 700-mb. contours (solid) and height departures from normal (dotted), both in tens of feet, and (B) departure of average temperature from normal ( $^{\circ}$  F.) for October 16-31, 1962. Temperatures averaged below normal in the East under influence of northwesterly mean flow.

days, attended by considerable precipitation in adjacent areas, especially north and east of the Low.

There were also exceedingly dry areas, among them the Far Southwest (fig. 7) where trough conditions persisted but apparently without an adequate moisture source. Phoenix, Ariz., reported only a trace of rain and the driest March to October period on record. Yuma, Ariz., reported the first measurable precipitation since March 21 but the October total was only 0.05 in. Another dry area appeared east of the Divide adjacent to and including part of the Central Plains, where a weak component of dry, northerly anomalous flow (fig. 1) prevailed. Denver, Colo., reported 0.05 in. for October and the driest July-October period on record. Under the influence of the blocking in Canada, parts of the Dakotas and northern Minnesota had less than half the normal amounts. Rain-

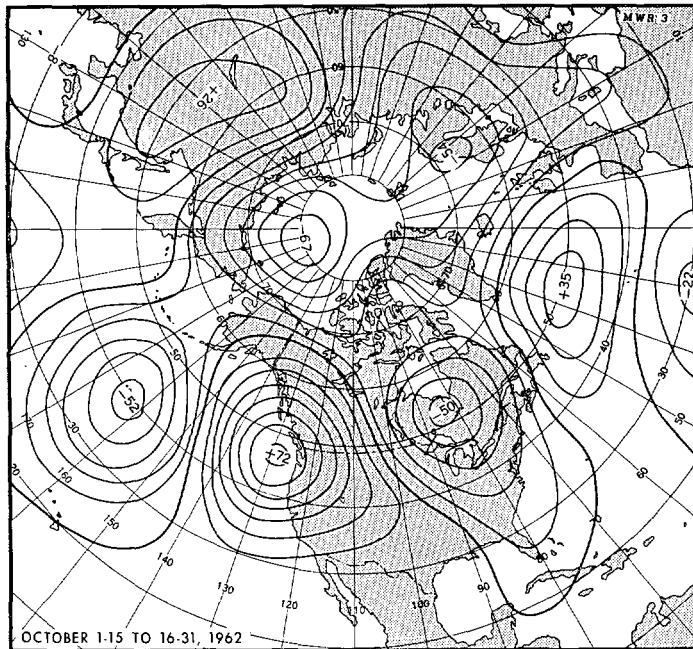


FIGURE 6.—Change of mean 700-mb. height (tens of feet) from first to second half of October 1962. A very strong reversal of the circulation is indicated over North America.

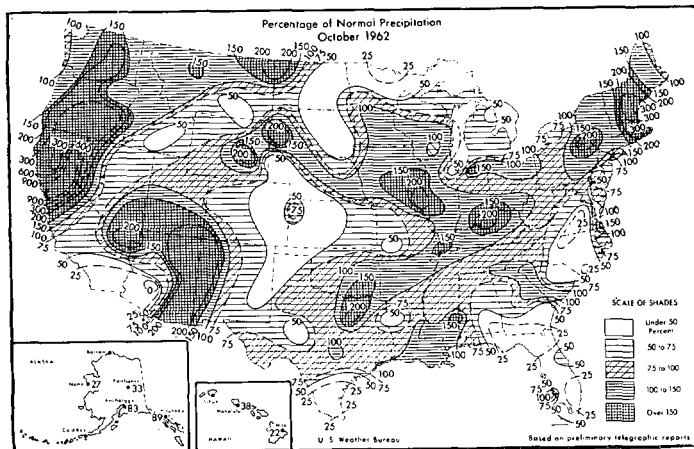


FIGURE 7.—Percentage of normal precipitation for October 1962. Amounts more than nine times normal were reported locally in California. (From [3].)

fall was also deficient in the Southeast to the rear of a mean trough with generally dry northwesterly flow aloft. Miami, Fla., reported the driest October of record and a precipitation deficit of 17.34 in. this year.

The cooling trend in the eastern half of the Nation during the last half of October was not sufficient to cool monthly average temperatures (fig. 8) below normal, except in the Northeast. This temperature pattern would not ordinarily be associated with the mean height anomaly distribution of figure 1 which suggests cooler

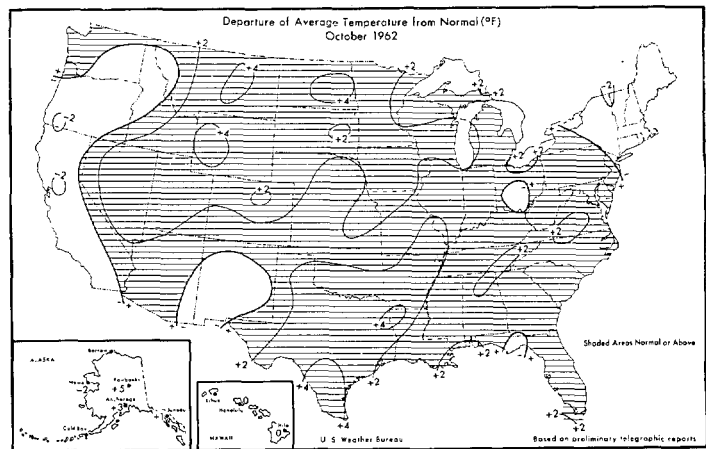


FIGURE 8.—Departure of average temperature from normal ( $^{\circ}$  F.) for October 1962. Temperatures averaged warmer than normal over most of the country. (From [3].)

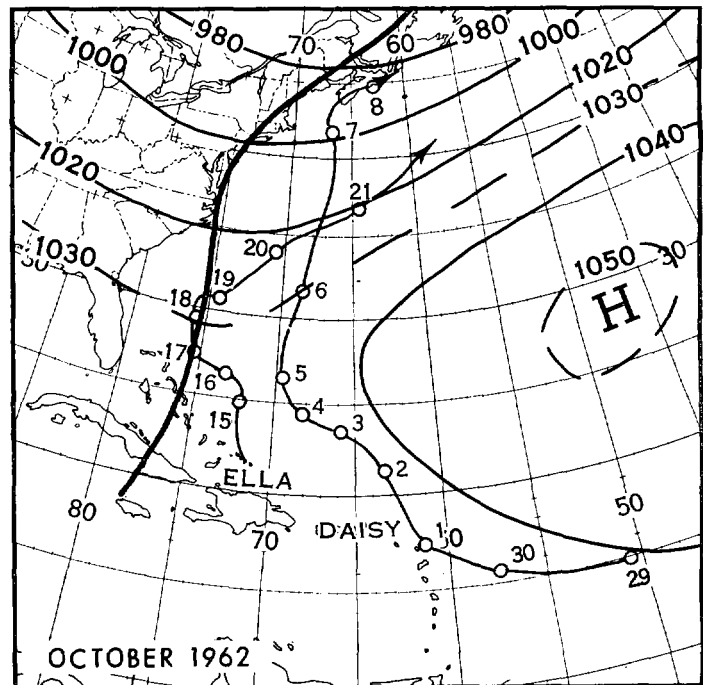


FIGURE 9.—Tracks of two Atlantic hurricanes superimposed upon 700-mb. height contours (same as fig. 1) for October 1962. Open circles and dates indicate 1200 GMT positions.

conditions in the East. However, the warm generally dry weather became established early and was the dominating weather regime for the month, perhaps suggesting heating effects of the initially warmed dry soil [4] in which some heat may have been stored during the first half of the month.

A rather large area of the central Rocky Mountain and northern Great Plains regions beneath the mean ridge of figure 1, and southern Texas remained warmer than normal throughout the month. Lander, Wyo. reported its warmest October on record.

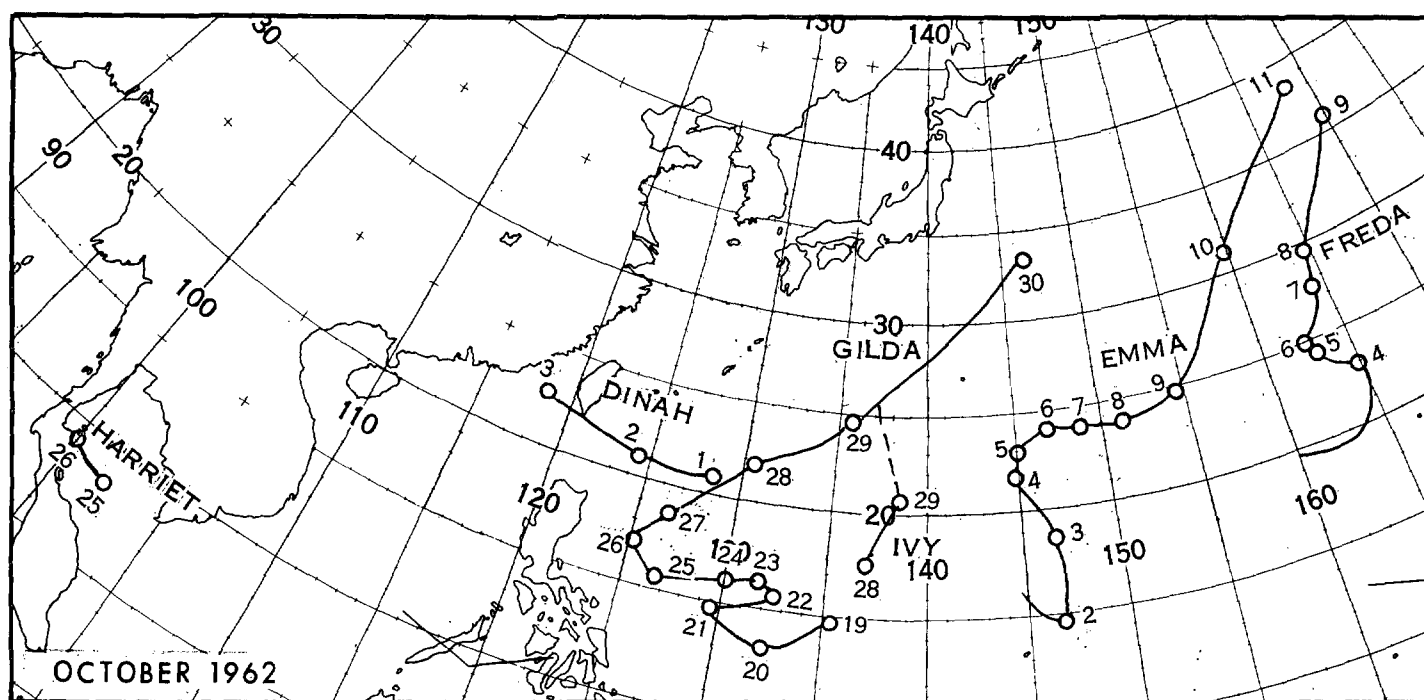


FIGURE 10.—Preliminary tracks of tropical storms during October 1962 in the western Pacific Ocean. Open circles and dates indicate 1200 GMT positions.

## 6. TROPICAL STORMS

Two tropical storms in the Atlantic correspond to the average frequency of two October storms. Favoring the development of tropical disturbances were the position and intensity of the subtropical High, which was stronger and slightly farther north than normal. Daisy (fig. 9) began as a tropical depression in late September and became a hurricane in early October. It moved slowly westward until the 5th, then accelerated northward, and combined with an intensifying frontal wave off the New England coast on the 7th.

Ella developed in an easterly wave east of the Bahamas on the 16th, moved slowly northward reaching hurricane intensity on the 18th, curved northeastward the following day, then accelerated to become extratropical by the 22d. Fast westerlies north of the 30th parallel at this time caused Ella to recurve sooner and travel faster toward the northeast than did Daisy, which was retarded by blocking.

There were numerous tropical disturbances in the western Pacific (fig. 10) where the subtropical High was displaced northward and the anomalous easterly flow was stronger than normal. Emma developed to typhoon intensity on the 3d, followed by Freda some 1000 miles to the east on the 4th. Emma was much the stronger of the two storms and traveled a peculiar path, recurving after the 4th to an eastward trajectory which continued several days. The huge circulation of Emma apparently aided the ejection of Freda rather quickly into the wester-

lies, and in resonance with the trough downstream probably contributed dynamically to the intensity of the trough where Freda redeveloped.

After Freda there was a lull in tropical activity until Gilda was detected on the 19th east of Luzon, P.I. Gilda moved slowly and erratically westward and recurved after the 25th without reaching the Philippine Islands. Typhoon Ivy, after its discovery on the 28th, moved northward and was absorbed by Gilda the following day.

Harriet became a tropical storm in the South China Sea on the 25th and weakened the next day near the Malay Peninsula. This storm was destructive in spite of its short life and maximum winds of only 50 kt. From Bangkok, Thailand, came estimates of 769 lives lost, over 10,000 persons made homeless, and property damage of \$15 million.

## REFERENCES

1. J. F. O'Connor, "The Weather and Circulation of September 1962—Another Cool Month," *Monthly Weather Review*, vol. 90, No. 12, Dec. 1962, pp. 527-534.
2. H. C. Sumner, "Pacific Coast Storm, October 11-13, 1962" (Preliminary Report), *Weekly Weather and Crop Bulletin, National Summary*, vol. XLIX, No. 43, Oct. 22, 1962.
3. U.S. Weather Bureau, *Weekly Weather and Crop Bulletin, National Summary*, vol. XLIX, No. 45, Nov. 5, 1962.
4. J. Namias, "Factors in the Initiation, Perpetuation and Termination of Drought," *International Union of Geodesy and Geophysics, Association of Scientific Hydrology, Publication No. 51*, 1960, pp. 81-94.